**Work Paper SCE13HC055**

**Process**

**Revision # 0**

**Southern California Edison**

**Circulating Block Heater**

At-a-Glance Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Measure 1 | Measure 2 | Measure 3 | Measure 4 |
| **Measure description** | 37-199 kW Backup Generator with Circulating Block Heater | 200-799 kW Backup Generator with Circulating Block Heater | 800-1099 kW Backup Generator with Circulating Block Heater | 1100-2500 kW Backup Generator with Circulating Block Heater |
| **Program delivery method** | Downstream | Downstream | Downstream | Downstream |
| **Measure application type** | ER, ROB | ER, ROB | ER, ROB | ER, ROB |
| **Base case description** | Source: Customer Existing  Existing thermo siphon heater on generator. | Source: Customer Existing  Existing thermo siphon heater on generator. | Source: Customer Existing  Existing thermo siphon heater on generator. | Source: Customer Existing  Existing thermo siphon heater on generator. |
| **Energy and demand impact common units** | Per unit | Per unit | Per Unit | Per Unit |
| **Peak Demand Reduction**  **(kW/unit)** | Varies by Climate Zone  CZ6 – 0.2019 kW | Varies by Climate Zone  CZ6 – 0.4099 kW | Varies by Climate Zone  CZ6 – 1.0365 kW | Varies by Climate Zone  CZ6 – 1.5763 kW |
| **Energy savings**  **(Base case – Measure)**  **(kWh/unit)** | Varies by Climate Zone  CZ6 – 1,618 kW | Varies by Climate Zone  CZ6 – 3,286 kW | Varies by Climate Zone  CZ6 – 8,309 kW | Varies by Climate Zone  CZ6 – 12,636 kW |
| **Gas savings**  **(Base case – Measure)**  **(therms/unit)** | 0 | 0 | 0 | 0 |
| **Full measure cost**[[1]](#footnote-1)  **($/unit)** | Source: Manufacturer Quote  $1,000 | Source: Manufacturer Quote  $1,800 | Source: Manufacturer Quote  $1,800 | Source: Manufacturer Quote  $1,800 |
| **Incremental measure cost[[2]](#footnote-2)**  **($/unit)** | Source: Manufacturer Quote  $250 | Source: Manufacturer Quote  $600 | Source: Manufacturer Quote  $600 | Source: Manufacturer Quote  $300 |
| **Effective useful life**  **(years)** | Source: DEER2014 (Motors-pump)  15 | Source: DEER2014 (Motors-pump)  15 | Source: DEER2014 (Motors-pump)  15 | Source: DEER2014 (Motors-pump)  15 |
| **Net-to-gross ratio(s)** | Source: DEER 2014 (ET-Default)  0.85 | Source: DEER 2014 (ET-Default)  0.85 | Source: DEER 2014 (ET-Default)  0.85 | Source: DEER 2014 (ET-Default)  0.85 |
| **Important comments** |  |  |  |  |

Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision # | Revision Date | Section-by-Section Description of Revisions | Author (Name, PA) |
| **0** | **10/06/2014** | **New Work Paper** | **Alfredo Gutierrez, SCE** |
|  |  |  |  |

# 

Commission Staff Review and Comment History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision # | Date Submitted to Commission Staff | Date Comments Received | Commission Staff Comments |
|  |  |  |  |
|  |  |  |  |

# 

# Table of Contents

At-a-Glance Summary

Document Revision History

Table of Contents

Section 1. General Measure & Baseline Data

* 1. Product Measures
  2. Program Implementation Overview
  3. Product Parameter Data

Section 2. Calculation Methods

2.1 Program Implementation Analysis

2.2 Electric Energy Savings Estimation Methodologies

2.3 Demand Reduction Estimation Methodologies

2.4 Gas Energy Savings Estimation Methodologies

Section 3. Load Shapes

Section 4. Base Case, Measure, and Installation Costs

4.1 Base Case(s) Costs

4.2 Measure Case Costs

4.3 Installation/Labor Costs

4.4 Incremental & Full Measure Costs

Appendix 1 – Supplemental Files

Appendix 2 – Commission Staff Comments/Review

Appendix 3 – Measure Application Type Definitions

Appendix 4 – CPUC Quality Metrics

Appendix 5 – DEER Resources Flow Chart

References

General Measure & Baseline Data

* 1. Product Measures

**General Description**

The measure is a circulating block heater used on backup diesel generators. This measure will replace an existing thermo siphon heater with a recirculation pump and a smaller resistance heater. The measure will be tiered based upon the backup generator sizes shown below:

• 37-199 kW

• 200-799 kW

• 800-1099 kW

• 1100-2500 kW

**Technical Description**

This technology has an integrated electric pump that circulates coolant throughout the engine block ensuring that there is a minimal temperature difference between the supply and return temperatures. The pump/heater (CBH) is an integral assembly. The existing thermo siphon heater is removed as a unit and the new CBH is inserted into the exact same location. It is a single unit installation within one housing with the mechanical element (pump) enclosed in the same "shell" as the smaller resistance heating element (relative to the thermo siphon) integral to the circulating block heater. Disconnect and reconnect points to existing hoses would not change unless improperly plumbed in the first place.

Along with the pump, a small resistance heater is used to heat the coolant within the engine block. When actual installations are completed, field inspections will verify if the existing resistance heater was replaced with smaller resistance heaters. By pumping the heated coolant, a more uniform temperature is obtained throughout the engine block. As a result of using a recirculation pump, a smaller electric resistance heater can be used to heat the coolant as there will be a more uniform temperature achieved through the mixing of fluid throughout the engine block.

The base case equipment is a thermo siphon heater. These types of heaters rely on the change in density (impacting buoyancy) in order to circulate the heated coolant. This type of circulation leads to non-uniform temperature distribution, where the coolant is warmer at the top of the block and colder at the bottom, which requires the electric resistance heater to operate for a longer duration. This also means that there is waste heat in sections of the block, as the heater must operate to maintain a certain temperature, so the top of the block will always be hotter than necessary.

The savings for these measures are taken from data collected by the Bonneville Power Administration (BPA) through their emerging technology program [A]. The data is collected from 17 different sites and includes both the existing thermo siphon heater and the circulating block heater.

* 1. Program Implementation Overview

**Implementation Methods**

The Delivery Mechanisms and Program Types are:

* **Downstream (Early Retirement, ER & Replace-on-Burnout, ROB)**
  + Installation of Circulating Block Heater should be performed by a qualified technician (i.e. generator maintenance technician or mechanical service technician).
  + Installer should assess and perform (if necessary) fluid hose adjustments that may be associated with the retrofit to enable the Circulating Block Heater to function at optimal energy efficiency.

**Program Restrictions and Guidelines**

**Eligibility Requirements**

* Existing backup generator is eligible for incentive if it is not currently fitted with Circulating Block Heater or device utilizing similar electro-mechanical system to heat generator block pre-warming fluid.
* New generator installation where base design prescribes a pre-heating device other than Circulating Block Heater or similar device may also apply for incentive to upgrade from base design to efficient design including a Circulating Block Heater.

**Implementation Requirements**

* All SCE climate zones are eligible
* All Non-Residential building types are eligible

**Measure Application Type**

See Implementation Methods above.

* 1. Product Parameter Data
     1. DEER Data

Currently, DEER does not address circulating block heaters. DEER, does, however, contain measures for circulation pump time clock retrofits (D03-095) and other water heating measures (both gas and electric, NE-WtrHt-SmlInst-Elec-lte12kW-lt2G, NG-WtrHt-LrgInst-Gas-gt200kBtuh-0p90Et, etc.). These measures, though, are not applicable proxies for circulating block heaters and cannot be used to determine the savings for the measures in this work paper. Also, DEER interactive effects will not be used as most backup generators are kept in non-conditioned or exterior spaces.

Table 1. DEER Difference Summary

|  |  |
| --- | --- |
| DEER | Used in Workpaper Approach? |
| Modified DEER methodology | No |
| Scaled DEER measure | No |
| DEER base case used | No |
| DEER measure case used | No |
| DEER building types Used | No |
| DEER operating hours used | No |
| Reason for Deviation from DEER | DEER does not contain this type of measure. |
| DEER Version | N/A |
| DEER ID and Measure Name (Sample) | N/A |

**Net-to-Gross**

**Table 2.** DEER Net-to-Gross Ratios

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| From DEER Tables | | | | | |
| NTGR\_ID | Description | Sector | Building Type | NTG | Program Delivery |
| ET-Default | Emerging Technologies approved by ED through work paper review | All | Any | 0.85 | Any |

**Effective Useful Life / Remaining Useful Life**

**Table 3.** DEER EUL Values/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | End Use | Measure | EUL (Years) | RUL (Years) |
| Motors-pump | Non-Residential | Process | Water Loop Pumps | 15 | 5 |

**In-Service Rate / First Year Installation Rate:**

**Table 4.** Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| From DEER Tables | | | | | |
| GSIA\_ID | Description | Sector | Building Type | GSIA Value | Program Delivery |
| Def-GSIA | Default GSIA values | Any | Any | 1.0 | Any |

**READi Technology Fields**

Table 5. READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measue Case UseCategory | Process Heat |
| Measure Case UseSubCats | Preheating of liquids/solids |
| Measure Case TechGroups | Liquid Circulation |
| Measure Case TechTypes | Pump - General Purpose Motor |
| Base Case TechGroups | Liquid Circulation |
| Base Case TechTypes | Thermostat |

* + 1. Codes & Standards Requirements Base Case and Measure Information

**Title 20:** The measures in this work paper are not covered by the 2014 Title 20 code [422].

**Title 24:** The measures in this work paper are not covered by the 2013 Title 24 code [355].

**AQMD:** Please note that the Air Quality Management District (AQMD) does set standards regarding what the definition of an emergency backup generator actually is and the allowable air emissions from backup generators. However, the allowable emissions do not impact savings calculations as backup generators are required to be ready at all times for use. Emission standards and are not covered in this work paper.

* + 1. Relevant EM&V Studies

There are no EM&V studies that have been used for this work paper.

* + 1. Relevant Workpaper Dispositions

There have been no dispositions on this work paper or any similar work paper.

* + 1. Other Sources for non-DEER Methods

The savings for the measures contained within this work paper are based on field monitoring data from the Bonneville Power Administration (BPA). This data was collected from numerous case studies that ran through the BPA’s Emerging Technology program. The data collected included average daily kWh and outside air (OA) temperature for both the preexisting thermo siphon heater and the retrofitted circulating block heater [A]. There are 17 sources of data, which are taken from different sites including waste water plants and data centers. The data was collected for different periods of time for each site, but on average, there are 2 months pre and post for each site used in the regression analysis performed for this work paper.

1. Calculation Methods
   1. Program Implementation Analysis

Table 6. Baseline by Measure Application Type

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Baseline | Baseline Technology | Duration |
| **ER** | First | Existing technology | 5 years |
| Second | Standard (existing technology) | 10 years |
| ROB | First | Standard (existing technology for this measure) | 15 |
| Second | N/A | N/A |

For ER, the program will ensure that the circulating block heaters are installed by a qualified technician/contractor. The program will also be required to ensure that the existing equipment falls within the EUL of the equipment so that ER can be claimed.

* 1. Electric Energy Savings Estimation Methodologies

The savings for the measures in this work paper are found from BPA field monitored case study data referenced above. The BPA case studies provide OA temperature and daily average kWh for both the preexisting thermo siphon heater and the measure. The data provided is used to create multiple regression models for the different generator sizes where this measure will be offered. These regression models, along with the circulating block heater tool used for SCE’s customized program can be found in attachment 2. The raw data used to generate the regression models has not been attached to this work paper due to size limitations, however, it is available upon request.

For example, figure 1 and figure 2 below show the regression models found for one of the sites for the thermo siphon heater and the circulating block heater, respectively. The generator size for this site would fall within the 800-1099 kW size range.

Figure 1 Daily Average kWh vs. Average Outside Air Temperature: Thermo Siphon

Figure 2 Daily Average kWh vs. Average Outside Air Temperature: Circulating Block Heater

With the regression models found for the 17 different sites, savings can be found for any OA temperature desired, however, the savings for this work paper assume the yearly average OA temperature from the updated 2013 CEC TMY3 weather files.

The 14 different regression models were grouped by generator size as follows:

Table 7 Regression model Mapping

|  |  |  |
| --- | --- | --- |
| Site | Site Reference ID | Generator Size (kW) |
| 1 | COCFD | 200-799 |
| 2 | KE ECAM | 200-799 |
| 3 | KRMC | 800-1099 |
| 4 | COCTV | 200-799 |
| 5 | TCWWTP | 37-199 |
| 6 | TCWP | 200-799 |
| 7 | HCNW | 37-199 |
| 8 | PCDC | 200-799 |
| 9 | COMW-ECAM | 200-799 |
| 10 | COMKR-ECAM | 200-799 |
| 11 | COCWWTP | 800-1099 |
| 12 | COCCH-ECAM | 37-199 |
| 13 | KID Kare | 37-199 |
| 14 | BayView | 800-1099 |
| 15 | BLDG 210-ECAM | 200-799 |
| 16 | BNS Gen\_1 | 800-1099 |
| 17 | NQ | 1100-2500 |

The average temperatures for each climate zone were found to be:

Table 8 Average Yearly Dry Bulb Temperature

|  |  |
| --- | --- |
| Climate Zone | Average Yearly Dry Bulb Temperature (°F) |
| 6 | 61.5 |
| 8 | 63.4 |
| 9 | 63.5 |
| 10 | 63.9 |
| 13 | 63.8 |
| 14 | 62.4 |
| 15 | 75.2 |
| 16 | 51.5 |

Using the above temperatures, the savings were found for each climate zone using the 14 separate regression models. It was assumed that the heaters within the generators are operating 334 days out of the year, though the generators are only used during emergencies, with only a month of downtime for maintenance. The savings for the measures, using the assumptions from above, are shown in the table below.

Table 9 Circulating Block Heater Savings

|  |  |  |  |
| --- | --- | --- | --- |
| Measure | Climate Zone | kWh Savings | kW Savings |
| 37-199 kW Generator with Circulating Block Heater | 6 | 1,618 | 0.20 |
| 8 | 1,648 | 0.21 |
| 9 | 1,648 | 0.21 |
| 10 | 1,648 | 0.21 |
| 13 | 1,648 | 0.21 |
| 14 | 1,618 | 0.20 |
| 15 | 1,830 | 0.23 |
| 16 | 1,466 | 0.18 |
| 200-799 kW Generator with Circulating Block Heater | 6 | 3,286 | 0.41 |
| 8 | 3,333 | 0.42 |
| 9 | 3,333 | 0.42 |
| 10 | 3,333 | 0.42 |
| 13 | 3,333 | 0.42 |
| 14 | 3,286 | 0.41 |
| 15 | 3,619 | 0.45 |
| 16 | 3,048 | 0.38 |
| 800-1099 kW Generator with Circulating Block Heater | 6 | 8,309 | 1.04 |
| 8 | 8,428 | 1.05 |
| 9 | 8,428 | 1.05 |
| 10 | 8,428 | 1.05 |
| 13 | 8,428 | 1.05 |
| 14 | 8,309 | 1.04 |
| 15 | 9,144 | 1.14 |
| 16 | 7,713 | 0.96 |
| 1100-2500 kW Generator with Circulating Block Heater | 6 | 12,636 | 1.58 |
| 8 | 14,267 | 1.78 |
| 9 | 14,267 | 1.78 |
| 10 | 14,267 | 1.78 |
| 13 | 14,267 | 1.78 |
| 14 | 12,636 | 1.58 |
| 15 | 24,054 | 3.00 |
| 16 | 4,480 | 0.56 |

Please note that DEER interactive effects are not used in the calculation of the energy savings as the equipment will either be installed outside or in an unconditioned room.

**First Baseline**

The energy savings for the first baseline can be found in Table 9 above.

**Second Baseline**

Please note that the measures have the same savings for the first and second baseline as there is no code/standard known to the author.

* 1. Demand Reduction Estimation Methodologies

As the heaters within the generators are assumed to operate continuously for 334 days out of the year, with one month of downtime, the kW savings are found through the following equation:

As the circulating block heaters operate continuously, they coincide with the DEER defined peak period. As such, the full kW savings are given for these measures.

**First Baseline**

Please see Table 9 for the kW savings for each measure.

**Second Baseline**

Please note that the measures have the same savings for the first and second baseline as there is no code/standard known to the author.

* 1. Gas Energy Savings Estimation Methodologies

There is no gas savings claimed for these measures.

**First Baseline**

N/A

**Second Baseline**

N/A

1. Load Shapes

The difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for this measure is the Industrial load shape. See table below for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table 10. Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alternate Building Type | Load Shape |
| Agricultural | Industrial | Industrial |
| Assembly | Industrial | Industrial |
| Health/Medical - Clinic | Industrial | Industrial |
| Education - Community College | Industrial | Industrial |
| Education - Primary School | Industrial | Industrial |
| Education - Relocatable Classroom | Industrial | Industrial |
| Education - Secondary School | Industrial | Industrial |
| Education - University | Industrial | Industrial |
| Food Store | Industrial | Industrial |
| Grocery | Industrial | Industrial |
| Lodging - Guest Rooms | Industrial | Industrial |
| Health/Medical - Hospital | Industrial | Industrial |
| Lodging - Hotel | Industrial | Industrial |
| Industrial | Industrial | Industrial |
| Manufacturing - Bio/Tech | Industrial | Industrial |
| Misc - Commercial | Industrial | Industrial |
| Manufacturing - Light Industrial | Industrial | Industrial |
| Lodging - Motel | Industrial | Industrial |
| Health/Medical - Nursing Home | Industrial | Industrial |
| Office - Large | Industrial | Industrial |
| Office - Small | Industrial | Industrial |
| Restaurant - Fast-Food | Industrial | Industrial |
| Restaurant - Sit-Down | Industrial | Industrial |
| Retail - Multistory Large | Industrial | Industrial |
| Retail - Single-Story Large | Industrial | Industrial |
| Retail - Small | Industrial | Industrial |
| Storage - Conditioned | Industrial | Industrial |
| Storage - Unconditioned | Industrial | Industrial |
| Transportation - Communication - Utilities | Industrial | Industrial |
| Warehouse - Refrigerated | Industrial | Industrial |

1. Base Case, Measure, and Installation Costs

Table . Measure cost summary by application type for 37-199 kW Backup Generator

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Measure Application Type | Base Case  Equipment Cost  ($/unit) | Measure  Equipment Cost  ($/unit) | Installation Cost  ($/Unit) | Incremental Measure Cost  ($/unit) | Full Measure Cost  (1st Baseline period)[[3]](#footnote-3)  ($/unit) | Full Base Cost  (2nd baseline period)[[4]](#footnote-4)  ($/unit) |
| **ROB** | $150 | $400 | N/A | $250 | N/A | N/A |
| **NC** |  |  | N/A |  | N/A | N/A |
| ER | $150 | $400 | $600 | N/A\* | $1000 | N/A |
| REA |  |  |  | N/A\* |  |  |

\* IMC may be useful for determining program incentive.

Table . Measure cost summary by application type for 200-799 kW Backup Generator

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Measure Application Type | Base Case  Equipment Cost  ($/unit) | Measure  Equipment Cost  ($/unit) | Installation Cost  ($/Unit) | Incremental Measure Cost  ($/unit) | Full Measure Cost  (1st Baseline period)[[5]](#footnote-5)  ($/unit) | Full Base Cost  (2nd baseline period)[[6]](#footnote-6)  ($/unit) |
| **ROB** | $600 | $1200 | N/A | $600 | N/A | N/A |
| **NC** |  |  | N/A |  | N/A | N/A |
| ER | $600 | $1200 | $600 | N/A\* | $1800 | N/A |
| REA |  |  |  | N/A\* |  |  |

\* IMC may be useful for determining program incentive.

Table . Measure cost summary by application type for 800-1099 kW Backup Generator

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Measure Application Type | Base Case  Equipment Cost  ($/unit) | Measure  Equipment Cost  ($/unit) | Installation Cost  ($/Unit) | Incremental Measure Cost  ($/unit) | Full Measure Cost  (1st Baseline period)[[7]](#footnote-7)  ($/unit) | Full Base Cost  (2nd baseline period)[[8]](#footnote-8)  ($/unit) |
| **ROB** | $600 | $1200 | N/A | $600 | N/A | N/A |
| **NC** |  |  | N/A |  | N/A | N/A |
| ER | $600 | $1200 | $600 | N/A\* | $1800 | N/A |
| REA |  |  |  | N/A\* |  |  |

\* IMC may be useful for determining program incentive.

Table . Measure cost summary by application type for 1100-2500 kW Backup Generator

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Measure Application Type | Base Case  Equipment Cost  ($/unit) | Measure  Equipment Cost  ($/unit) | Installation Cost  ($/Unit) | Incremental Measure Cost  ($/unit) | Full Measure Cost  (1st Baseline period)[[9]](#footnote-9)  ($/unit) | Full Base Cost  (2nd baseline period)[[10]](#footnote-10)  ($/unit) |
| **ROB** | $1200 | $1500 | N/A | $300 | N/A | N/A |
| **NC** |  |  | N/A |  | N/A | N/A |
| ER | $1200 | $1500 | $300 | N/A\* | $1800 | N/A |
| REA |  |  |  | N/A\* |  |  |

\* IMC may be useful for determining program incentive.

* 1. Base Case(s) Costs

The base case equipment costs for these measures are found from equipment manufacturers quotes. DEER was not used as it does not address this type of measure.

* 1. Measure Case Costs

The measure case costs for these measures are also found from equipment manufacture quotes. DEER was not used as it does not address this type of measure.

* 1. Installation/Labor Costs

The labor costs for these measures come from SCE’s customized program for actual installation of this technology. DEER was not used as it does not address this type of measure.

* 1. Incremental & Full Measure Costs

**Table 15.** Incremental and full measure cost calculations

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Incremental Measure Cost  ($/unit) | Full Measure Cost  (1st Baseline period)  ($/unit) | Full Base Cost  (2nd baseline period)  ($/unit) |
| ROB/NEW | **Incremental Measure Cost** =  (Measure Equipment Cost + Measure Labor Cost) –  (Base Case Equipment Cost + Base Case Labor Cost) | N/A | N/A |
| ER | N/A | **Full Measure Cost** =  Measure Equipment Cost + Labor Cost | **Full Base Cost** =  (-1)\*(Second Base Case Equipment Cost + Labor Cost)[[11]](#footnote-11) |
| REA | N/A | **Full Measure Cost =**  Measure Equipment Cost + Labor Cost | N/A |

Table . Incremental and full measure cost values for 37-199 kW Backup Generator

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Incremental Measure Cost  ($/unit) | Full Measure Cost  ($/unit) | Full Base Cost  (2nd Baseline)  ($/unit) |
| ROB/NEW | $250 | N/A | N/A |
| ER | N/A | $1000 | N/A |
| REA | N/A |  | N/A |

Table . Incremental and full measure cost values for 200-799 kW Backup Generator

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Incremental Measure Cost  ($/unit) | Full Measure Cost  ($/unit) | Full Base Cost  (2nd Baseline)  ($/unit) |
| ROB/NEW | $600 | N/A | N/A |
| ER | N/A | $1800 | N/A |
| REA | N/A |  | N/A |

Table . Incremental and full measure cost values for 800-1099 kW Backup Generator

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Incremental Measure Cost  ($/unit) | Full Measure Cost  ($/unit) | Full Base Cost  (2nd Baseline)  ($/unit) |
| ROB/NEW | $600 | N/A | N/A |
| ER | N/A | $1800 | N/A |
| REA | N/A |  | N/A |

Table . Incremental and full measure cost values for 1100-2500 kW Backup Generator

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Application Type | Incremental Measure Cost  ($/unit) | Full Measure Cost  ($/unit) | Full Base Cost  (2nd Baseline)  ($/unit) |
| ROB/NEW | $300 | N/A | N/A |
| ER | N/A | $1800 | N/A |
| REA | N/A |  | N/A |

# Appendix 1 - Supplemental Files







# Appendix 2 – Commission Staff Comments / Review

Include embedded file(s) with Commission staff feedback.

# Appendix 3 - Measure Application Type Definitions

The DEER Measure Cost Data Users Guide found on [www.deeresources.com](http://www.deeresources.com) under *DEER2011 Database Format* hyperlink, DEER2011 for 13-14, spreadsheet *SPTdata\_format-V0.97.xls*, defines the measure application type terms as follows:

Measure Application Type

|  |  |  |
| --- | --- | --- |
| Code | Description | Comment |
| ER | Early retirement | Measure applied while existing equipment still viable, or retrofit of existing equipment |
| EAR | Retrofit Add-on | Retrofit to existing equipment without replacement |
| ROB | Replace on Burnout | Measure applied when existing equipment fails or maintenance requires replacement |
| NC | New Construction | Measure applied during construction design phase as an alternative to a code-compliant standard design |

Baseline Technologies for UES and Cost calculations[[12]](#footnote-12)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Measure Application Type | Baseline | Baseline Technology | Measure Cost Calculation | Duration |
| ER | First | Existing technology | Measure equipment cost + labor cost | RUL = 1/3\*EUL[[13]](#footnote-13) |
| Second | Code or standard | (-1)\*(Code/standard equipment cost + labor cost) | EUL - RUL |
| REA | First | Existing technology | Measure equipment cost + labor cost | EUL |
| Second | N/A | N/A | N/A |
| ROB | First | Code or standard | (Measure equipment cost + labor cost) – (Code/standard cost + labor cost) | Full EUL |
| Second | N/A | N/A | N/A |
| NC | First | Code or standard | (Measure equipment cost + labor cost) – (Code/standard cost + labor cost) | Full EUL |
| Second | N/A | N/A | N/A |

Measure cost overview developed by SCE:

**

# Appendix 4 – CPUC Quality Metrics

CPUC workpaper development actions to ensure quality are listed below, adapted from ex ante implementation scoring metrics described in Attachment 7 of Decision (D).13-09-023. The corresponding scoring metrics are shown below.

|  |  |
| --- | --- |
| **Metric** | **Workpaper Development Action to Ensure Quality** |
| 2 | Address all aspects of the Uniform Workpaper Template[[14]](#footnote-14) |
| 3a[[15]](#footnote-15) | Include appropriate program implementation background |
| 3b | Include analysis of how implementation approach influences development of ex ante values |
| 3c | Include all applicable supporting materials |
| 3d | Include an adequate[[16]](#footnote-16) description of assumptions or calculation methods |
| 4 | Pursue up-front collaboration on high impact measures with Commission staff prior to formal submission for review |
| 7 | Include analysis of recent and relevant existing data and projects that are applicable to workpaper technologies for parameter development that reflects professional care, expertise, and experience |
| 9 | Appropriately incorporate DEER assumptions, methods, and values for new or modified existing measures using professional care and expertise |
| 10 | Incorporate cumulative experience into workpaper through inclusion of an analysis of previous activities, reviews, and direction. (ED expects IOUs to immediately incorporate disposition guidance into workpapers to be submitted for formal review) |

# Appendix 5 – DEER Resources Flow Chart



# References

[31] KEMA Inc, JJ Hirsch and Associates, Itron Inc. (2006). Load Shape Update Initiative-Final Report.

[351] California Public Utilities Commission. (2013). Energy Efficiency Policy Manual-Version 5

[355] California Energy Commission. "2013 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)." CEC‐400‐2012‐004-CMF-REV2 (2013).

[422] California Energy Commission. "2014 Appliance Efficiency Regulations (Title 20)." CEC-400-2014-009-CMF (2014).

[436] 2014 Database for Energy Efficient Resources (DEER). 2014 DEER EUL Table - Update (DEER2014-EUL-table-update\_2014-02-05.xlsx).

[A] Bonneville Power Administration (BPA). (2014). Emerging Technology field Test Results and Future Opportunities.

1. Full measure cost = measure equipment cost + measure labor cost [↑](#footnote-ref-1)
2. Incremental measure cost = Measure equipment cost – Baseline equipment cost [↑](#footnote-ref-2)
3. Full measure cost = measure equipment cost + installation cost, for first baseline period [↑](#footnote-ref-3)
4. Full base cost = 2nd baseline equipment cost + installation cost, for the second baseline period [↑](#footnote-ref-4)
5. Full measure cost = measure equipment cost + installation cost, for first baseline period [↑](#footnote-ref-5)
6. Full base cost = 2nd baseline equipment cost + installation cost, for the second baseline period [↑](#footnote-ref-6)
7. Full measure cost = measure equipment cost + installation cost, for first baseline period [↑](#footnote-ref-7)
8. Full base cost = 2nd baseline equipment cost + installation cost, for the second baseline period [↑](#footnote-ref-8)
9. Full measure cost = measure equipment cost + installation cost, for first baseline period [↑](#footnote-ref-9)
10. Full base cost = 2nd baseline equipment cost + installation cost, for the second baseline period [↑](#footnote-ref-10)
11. The E3 calculator determines the net present value of the second baseline cost and subtracts it from the first baseline cost to determine the measure cost for the early retirement measure. According to the Energy Efficiency Policy Manual v.5 at page 32, the measure cost for an early-retirement case is “the full cost incurred to install the new high-efficiency measure or project, reduced by the net present value of the full cost that would have been incurred to install the standard efficiency second baseline equipment at the end of the [RUL] period”. [↑](#footnote-ref-11)
12. According to the Energy Efficiency Policy Manual v.5 at page 32, the measure cost for an early-retirement case is “the full cost incurred to install the new high-efficiency measure or project, reduced by the net present value of the full cost that would have been incurred to install the standard efficiency second baseline equipment at the end of the [RUL] period”. Page 33 elaborates that “the period between the RUL and EUL defines the second baseline calculation period…the measure cost for this period is the full cost of equipment, including installation, for the second baseline equipment measure”. [↑](#footnote-ref-12)
13. The Energy Efficiency Policy Manual v.5 at page 33 states “the remaining useful life (RUL)…[is established by DEER] as one-third of the expected useful life (EUL) for the equipment type”. [↑](#footnote-ref-13)
14. The Uniform Workpaper Template is not posted on the DEER website as of 4/21/14, and is currently in Microsoft Access Database format. [↑](#footnote-ref-14)
15. Metric 3 is not split among a – d in Attachment 7, however metric 3 was separated into four subcategories in this document for the purposes of identifying individual workpaper development actions to address quality. [↑](#footnote-ref-15)
16. “Adequate” is defined in Attachment 7 such that derivations of underlying assumptions of workpaper are easy to understand by the CPUC reviewer. [↑](#footnote-ref-16)